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ABSTRACT

One of the most controversial issues in financial economics is the question of whether stocks overreact. Using portfolios formed on the basis of prior 5-year returns, we find that there is an economically important overreaction effect. Depending upon the exact procedure employed, extreme prior losers subsequently outperform extreme prior winners by 5-10 percent per year during the subsequent 5 years. This overreaction effect is substantially stronger for smaller firms than for larger firms. It is unlikely that the overreaction effect can be attributed to risk mismeasurement, since returns consistent with the overreaction hypothesis are also observed for short windows around quarterly earnings announcements.

1. Introduction

The predictability of stock returns has arguably been the most controversial financial research topic of recent years. Various researchers have documented predictable returns over long and short horizons for both individual securities and indices.[1] While there is now a consensus that returns are predictable, there is widespread disagreement about the underlying reasons for this predictability. As stated by Fama (1991), the interpretation of the return predictability evidence runs "head-on into the joint-hypothesis problem; that is, does return predictability reflect rational variation through time in expected returns, irrational deviations of price from fundamental value, or some combination of the two?" One of the most influential, and most controversial, papers in this line of research is De Bondt and Thaler (1985), in which evidence of economically important return reversals over long intervals is presented. In particular, stocks that experience poor performance over the past 3 to 5 years (losers) tend to substantially outperform prior-period winners over the subsequent 3 to 5 years. De Bondt and Thaler interpret their evidence as a manifestation of irrational behavior by investors, which they term "overreaction."

Various authors (Chan (1988), Ball and Kothari (1989)), however, have argued that these return reversals are primarily a manifestation of systematic changes in equilibrium required returns that were not captured by De Bondt and Thaler. One of the main arguments for why required returns

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[1] Among the many recent studies documenting time-series return predictability for long and short horizons are Rosenberg, Reid and Lanstein (1985), Fama and French (1988), Poterba and Summers (1988), Conrad and Kaul (1989), Jagadeesh (1990) and Lehmann (1990).

on extreme winners and losers vary substantially follows from pronounced changes in leverage. Since the equity beta of a firm is a function of both the firm's asset risk and its leverage, a series of negative abnormal returns will increase the equity beta of a firm, increasing the expected return on the stock.[2] Following the same logic, a decrease in the equity beta is expected for winners. Consistent with the prediction of the leverage hypothesis, Ball and Kothari report that the betas of extreme losers exceed the betas of extreme winners by a full 0.76 following the portfolio formation period. Such a large difference in betas, coupled with historical risk premiums, can account for substantial differences in realized returns.

Another reason that has been advanced for why losers outperform winners relates to the size effect. Zarowin (1990) and others have argued that the superior performance of losers relative to winners is not due to investor overreaction, but instead is a manifestation of the size effect, in that losers tend to be smaller-sized firms than winners.

In general, attempts to discriminate between market inefficiency and changing equilibrium required returns are most difficult when long return intervals are used. This is because the measurement of abnormal performance over long horizons is very sensitive to the performance benchmark used, as emphasized by Dimson and Marsh (1986). In this paper, in addition to allowing time-variation in betas as recently applied in this context by Ball and Kothari (1989), we introduce three methodological innovations that enable us to perform a comprehensive evaluation of the

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[2]This assumes that the asset beta is positive and that the firm does not change its debt to fully offset the decline in the value of its equity.

overreaction hypothesis. This methodology is applicable to any study measuring abnormal performance over long horizons.

First, we use the empirically-determined price of beta risk, rather than that assumed by a specific highly-structured model such as the Sharpe-Lintner CAPM. As Ball and Kothari document, the betas of extreme prior-period winners and losers differ dramatically. Consequently, large differences in returns between winners and losers can be accounted for by the Sharpe-Lintner CAPM, in which the compensation per unit of beta risk is r_m-r_f, where r_m is the return on the market and r_f is the risk-free rate. In the 1931-82 period, r_m-r_f averages almost 15 percent per year using an equally-weighted index of NYSE stocks for r_m and Treasury bills for r_f. The Sharpe-Lintner CAPM assumption is innocuous in many other studies, where the portfolio betas typically do not differ much from 1.0. But in this study, the betas of winners are markedly different from the betas of losers. Numerous empirical studies, starting with Black, Jensen, and Scholes (1972), find a much flatter slope than that assumed by the Sharpe-Lintner CAPM.[3] By using empirical estimates of the market compensation per unit of beta risk, our methodology avoids the model misspecification that occurs when r_m-r_f is assumed to be the market price per unit of beta risk.

Second, numerous studies have found a relation between size and future returns. Portfolios of losers are typically comprised of smaller stocks than portfolios of winners. Thus, in order to ascertain whether

[3] Black, Jensen, and Scholes (1972), Fama and MacBeth (1973), Tinic and West (1984), Lakonishok and Shapiro (1986), Amihud and Mendelson (1989), Ritter and Chopra (1989), and Kan (1991), among others, find flatter slopes than predicted by the Sharpe-Lintner CAPM.

there is an independent overreaction effect, a size adjustment is appropriate. However, because small-firm portfolios are intensive in losers, the common procedure of adjusting for size might overadjust and thus create a bias against finding an independent overreaction effect. To address this possibility, we purge our size-control portfolios of stocks with extreme performance.[4] This methodology enables us to disentangle the effects of size and prior performance in calculating abnormal returns on winner and loser portfolios. In addition, we explore the generality of the effect in both January and non-January months.

Third, abnormal returns calculated over long intervals are inherently sensitive to the benchmark used. Currently, there is no consensus on what is the "best" benchmark to use. Because of this problem, research documenting abnormal returns calculated over long intervals is frequently treated with suspicion. Therefore, in one of our tests, we minimize this problem by focusing on short windows in which a relatively large amount of new information is disseminated. This approach is analogous to that employed by Bernard and Thomas (1989, 1991) in their investigation of abnormal returns following earnings announcements. In the three-day period in which quarterly earnings announcements occur, we compute abnormal returns for winners and losers. In our context, positive abnormal returns at subsequent earnings announcements for prior losers, and negative abnormal returns for prior winners, are consistent with the overreaction

[4] Fama and French (1986) use a nearly identical procedure for controlling for size effects. For size deciles, they compare the average return on prior winners and losers with stocks in the same size decile that were in the middle 50 percent of returns during the portfolio formation period. They use 3-year periods rather than 5-year periods, but find qualitatively similiar results to those reported here.

hypothesis. In drawing our inferences, we are careful in adjusting for size effects and the higher volatility that other researchers (e.g., Chari, Jagannathan, and Ofer (1988)) have documented at earnings announcement dates.

Our results indicate that there is an economically significant overreaction effect present in the stock market. Moreover, it is very unlikely that this effect can be attributed to measurement problems since returns consistent with the overreaction hypothesis are also observed for short windows around quarterly earnings announcements. Depending upon the exact procedure employed, extreme losers outperform extreme winners by 5 to 9 percent per year in the years following the portfolio formation period. Although disproportionately concentrated in January, there is evidence that this overreaction effect is present in other months as well. The overreaction effect, however, is not uniform across all size groups. Instead, it is much stronger among smaller firms, which are predominantly held by individuals. Indeed, there is at most only weak evidence of an overreaction effect among the largest firms, which are predominantly held by institutions. One interpretation of our findings might be that individuals overreact, but institutions don't.

The structure of the remainder of this paper is as follows. In Section 2, we measure the extent of abnormal performance for portfolios formed on the basis of prior returns while controlling for, alternately, beta and size effects. In Section 3, we present evidence on the abnormal returns for winners and losers while simultaneously controlling for beta and size effects. We also explore seasonal and cross-sectional patterns in the extent of overreaction. In Section 4, we present evidence from the

market's reaction to earnings announcements. Section 5 concludes the paper.

2. Beta and Size-adjusted Excess Returns

A. Methodology

For comparability with prior studies (e.g., Ball and Kothari (1989)) we use the CRSP monthly tape of New York Stock Exchange issues from 1926 to 1986. All stocks that are continuously listed for the prior 5 calendar years are ranked each year on the basis of their 5-year returns and assigned to one of twenty (vitile) portfolios. Thus, the first ranking period ends in December 1930, and the last one ends in December 1981, a total of 52 ranking periods. The post-ranking periods are overlapping 5-year intervals starting with 1931-35 and ending with 1982-86. For each of the vitile portfolios, this procedure results in a time series of 52 portfolio returns for each of the 10 event years -4 to +5, with the last year of the ranking period designated as year 0. These 52 observations are used to estimate betas and abnormal returns for the 10 event years.

Annual portfolio returns for each firm are constructed from the monthly CRSP returns by compounding the monthly returns in a calendar year to create an annual buy and hold return. The annual returns of the firms assigned to a portfolio are then averaged to get the portfolio's annual return.[5]

To estimate the market model coefficients, we use Ibbotson's (1975) Returns Across Time and Securities (RATS) procedure. For each event year

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[5] If a firm is delisted within a calendar year, its annual return for that year is calculated by using the CRSP equally-weighted index return for the remainder of that year. In subsequent years, the firm is deleted from the portfolio.

τ= -4, ... 0, +1, ...+5 and vitile portfolio p, we run the following regression using 52 observations:

$$r_{pt}(\tau)-r_{ft} = \alpha_p(\tau) + \beta_p(\tau)[r_{mt}-r_{ft}] + e_{pt}(\tau) \qquad (1)$$

where $r_{pt}(\tau)$ is the annual return on portfolio p in calendar year t and event year τ, r_{mt} is the equally-weighted market return on NYSE stocks meeting our sample selection criteria in calendar year t, and r_{ft} is the annual return on T-bills (from Ibbotson Associates (1988)). The intercept in equation (1) is known as Jensen's (1969) alpha, and is a measure of abnormal performance.

B. Beta-adjusted excess returns

In columns (1)-(3) of Table 1, we have formed portfolios on the basis of ranking firms by their prior 5-year returns. We report the annual returns, alphas, and betas averaged over the five years following the portfolio formation (ranking) period. Our numbers are slightly different from those reported in Ball and Kothari's Table 1 because of the different sample selection criteria employed. Ball and Kothari require that their firms remain listed on the NYSE for the entire 5-year post-ranking period, whereas we do not impose such a requirement.[6]

[Insert Table 1 about here]

The most striking result in Table 1 is the inverse relation between the past and subsequent returns. Portfolio 1 (the prior-period losers) has a post-ranking period average annual return of 27.3 percent, while

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[6]Ball and Kothari's sample selection criteria imposes a survivorship bias. In our sample, approximately 22 percent of the extreme loser vitile firms are delisted by the end of the post-ranking period, and approximately 8 percent of the extreme winner vitile firms are delisted. In the 1930s, many of the delistings occurred due to bankruptcies, whereas by the 1970s, takeovers are the main reason for delistings. As might be expected, bankruptcies are very rare among the extreme winners.

Table 1

Average annual post-ranking period percentage returns, alphas, and betas for vitile portfolios formed on the basis of (i) ranking-period returns, or (ii) ranking-period betas.

Alphas and betas are estimated from time-series regressions with 52 observations, for ranking periods ending in 1930-81, for each of the 5 post-ranking years. The alphas and betas reported are the averages of these 5 numbers. In columns (1)-(5) and (9)-(11), portfolio 1 is comprised of stocks with the lowest ranking-period returns, and portfolio 20 is comprised of the stocks with the highest ranking-period returns. In columns (6)-(8), portfolio 1 is comprised of stocks having the highest ranking-period betas, and portfolio 20 is comprised of stocks having the lowest ranking-period betas. In columns (2)-(3), (7)-(8), and (10)-(11), alphas and betas are computed using an equally-weighted market index, whereas in columns (4)-(5), alphas and betas are computed using a value-weighted index. Columns (1)-(8) are based upon annual returns, whereas columns (9)-(11) are based upon monthly returns.

	Portfolios formed on the basis of ranking-period returns					Portfolios formed on the basis of ranking-period betas			Portfolios formed on the basis of ranking-period returns		
	Average annual	Computed using EW market		Computed using VW market		Average annual			Average monthly		
Portfolio	return (1)	alpha (2)	beta (3)	alpha (4)	beta (5)	return (6)	alpha (7)	beta (8)	return (9)	alpha (10)	beta (11)
1	27.3	-0.2	1.65	2.7	1.95	21.0	-3.0	1.42	2.36	0.26	1.52
2	23.0	0.5	1.31	2.5	1.62	19.4	-3.5	1.34	1.90	0.07	1.30
3	21.0	0.1	1.20	1.9	1.51	20.3	-1.2	1.25	1.80	0.05	1.23
4	21.2	0.9	1.16	2.9	1.45	20.4	-0.8	1.22	1.73	0.09	1.14
5	20.5	1.2	1.09	2.8	1.39	21.0	-0.6	1.24	1.65	0.09	1.07
6	19.9	0.7	1.08	2.2	1.40	20.2	0.0	1.15	1.59	0.06	1.05
7	19.4	0.0	1.09	1.6	1.40	20.2	0.1	1.14	1.52	0.01	1.03
8	18.5	1.5	0.94	2.9	1.24	19.8	0.1	1.12	1.48	0.06	0.95
9	17.6	0.2	0.95	1.7	1.26	18.5	-0.2	1.04	1.41	-0.03	0.98
10	17.8	0.7	0.94	2.1	1.24	18.3	-0.5	1.06	1.43	0.03	0.94
11	16.9	0.2	0.91	1.4	1.22	19.3	0.5	1.05	1.35	-0.04	0.93
12	16.6	0.1	0.89	1.2	1.22	17.3	0.0	0.95	1.34	-0.03	0.92
13	16.7	0.2	0.90	1.4	1.22	17.2	0.4	0.91	1.33	-0.00	0.88
14	16.1	-0.2	0.88	0.8	1.21	17.2	0.8	0.89	1.29	-0.06	0.90
15	15.5	-0.2	0.84	0.9	1.16	16.2	0.9	0.82	1.25	-0.07	0.87
16	15.3	-0.6	0.85	0.3	1.18	15.4	0.6	0.78	1.20	-0.07	0.83
17	14.6	0.1	0.76	1.0	1.08	15.2	1.4	0.72	1.16	-0.05	0.78
18	14.5	-1.3	0.85	-0.5	1.18	14.2	1.7	0.62	1.10	-0.12	0.79
19	14.3	-1.3	0.84	-0.7	1.19	14.4	1.1	0.67	1.11	-0.12	0.79
20	13.3	-2.7	0.86	-2.0	1.21	13.7	2.1	0.56	1.01	-0.24	0.81
Mean	18.0	0.0	1.00	1.35	1.32	18.0	0.0	1.00	1.45	-0.06	0.98
r_1-r_{20}	14.0	2.5	0.79	4.7	0.74	7.3	-5.1	0.86	1.35	0.50	0.71

portfolio 20 (the prior-period winners) has an average post-ranking period average annual return of 13.3 percent, a difference of 14.0 percent per year.[7] Over the five-year post-ranking period, even before compounding, this difference cumulates to 70 percent! The debate revolves around how much of this difference is attributable to risk differences. In fact, as demonstrated by Ball and Kothari, much of this difference can be explained by the Sharpe-Lintner CAPM. According to column (3) of Table 1, the difference in post-ranking betas between the extreme winner and loser portfolios is 0.79. Given a market risk premium (r_m-r_f) in the 14-15 percent range using an equally-weighted portfolio of NYSE stocks, the CAPM predicts a difference in returns of approximately 11 percent, leaving only 3 or 4 percent of the 14.0 percent difference unaccounted for. Indeed, using this approach, Ball and Kothari report a difference in alphas between extreme winner and loser portfolios of 3.9 percent, which they view as economically insignificant.[8] Using our sample, we find a difference in alphas between extreme portfolios of 2.5 percent per year.

The conclusion that most of the difference in post-ranking returns

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[7] De Bondt and Thaler (1985) find a smaller difference in post-ranking period returns between winners and losers than we (and Ball and Kothari) do. In their Figure 3, they find a difference of about 8 percent per year for their 5 year post-ranking period, compared to our 14 percent per year. There are a number of reasons for this difference having to do with the sample construction, most notably because the definition of extreme winners and losers is not the same. In most of their work, De Bondt and Thaler define their portfolios as the most extreme 35 firms in each year, whereas we define our portfolios in terms of the most extreme vitiles. The number of firms in each of our vitile portfolios increases from about 20 in the 1930s to about 50 in the 1970s, averaging about 43 firms. A further difference is that our last ranking period ends in 1981, whereas their last ranking period ends in 1978.

[8] One can quibble about whether abnormal returns of 3.9 percent per year for 5 years is economically significant or not.

between winners and losers can be accounted for as compensation for risk-bearing is heavily dependent upon the Sharpe-Lintner CAPM's assumption that the return per unit of beta risk provided by the market is $r_m - r_f$. Empirical studies have invariably found a much flatter slope. Using the same sample and the same methodology as used in columns (1)-(3), we form portfolios on the basis of ranking-period betas.[9]

In columns (6)-(8), we report the average annual returns and the average alphas and betas computed using the RATS methodology for the 5 post-ranking years for portfolios formed on the basis of ranking-period betas. The dispersion in betas between the extreme portfolios reported in column (8) is 0.86, slightly greater than the 0.79 reported in column (3). This large difference in betas in column (8), however, is associated with a difference in returns between extreme portfolios of only 7.3 percent, dramatically less than the 14.0 percent reported when portfolios are formed on the basis of ranked prior returns. It should be noted that the only difference between columns (1)-(3) and (6)-(8) is in how the portfolios were formed: the universe of firms and the estimation methodology are identical.

Using the 20 portfolio returns and betas reported in columns (6) and (8), respectively, we estimate the market compensation per unit of beta risk. The resulting regression coefficents are an intercept of 8.6 percent and a slope of 9.4 percent. These coefficents are consistent with those

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[9] The ranking-period beta of each firm was calculated on the basis of a 60 observation regression using monthly returns during the ranking period. For each of the 52 ranking periods, firms were then ranked on the basis of these betas, and assigned to vitile portfolios. The post-ranking period portfolio betas were then estimated using the RATS procedure during each of the 5 post-ranking years with annual returns.

reported by other researchers and mentioned in footnote 3. Note that the 8.6 percent intercept is considerably higher than the average risk-free rate during the sample period of about 3.5 percent, and the slope coefficent of 9.4 percent is considerably lower than the 14-15 percent market risk premium. In other words, differences in betas do not generate differences in returns during the sample period as great as assumed by the Sharpe-Lintner CAPM.

[Insert Figures 1a and 1b about here]

In Figures 1a and 1b, we have plotted the regression equation estimated from the 20 portfolios formed on the basis of prior betas. The two extreme winner and loser portfolios are also plotted. In Figure 1a, we use annual data from columns (6) and (8) of Table 1. In Figure 1b, we use monthly data (not reported in Table 1). Using annual data, the extreme winner portfolio underperforms a portfolio with the same beta by 3.4 percent, while the extreme loser portfolio outperforms a portfolio with the same beta by 3.1 percent. Thus, the difference in abnormal returns is 6.5 percent, substantially higher than the 2.5 percent reported in column (2). The difference between these two numbers is attributable to different assumptions about the slope of the SML. Using a misspecified benchmark (too steep a slope) results in underestimating the overreaction effect because the abnormal return is computed as the deviation from the SML.

To examine the sensitivity of the results to the choice of a market index, columns 4 and 5 present results for annual measurement intervals using a value-weighted market index. The betas are all above 1.0, reflecting the fact that the equally-weighted index itself has a beta of 1.3 with respect to the value-weighted index. The difference in alphas

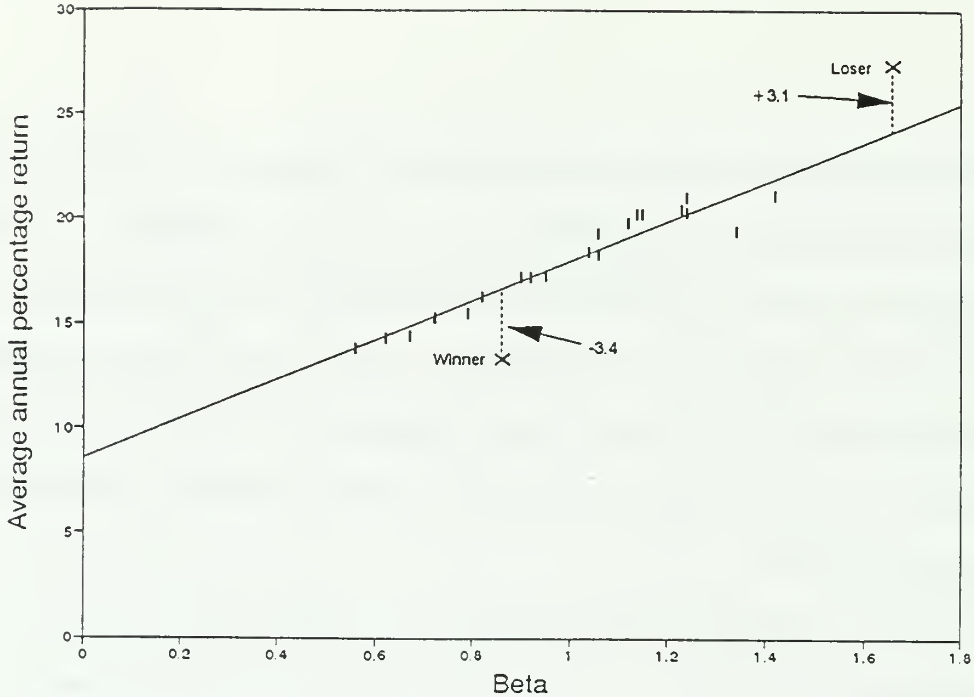

Fig. 1a. Plot of the empirical Security Market Line calculated using annual data from the realized post-ranking period returns and betas for vitile portfolios formed on the basis of ranking-period betas, and the realized post-ranking period return on extreme winner and loser portfolios.

The empirical SML is estimated from the 20 vitile returns and betas reported in columns (6) and (8) of Table 1. The empirical SML has an intercept of 8.6 percent and a slope of 9.4 percent. Alphas are calculated as deviations from the empirical SML.

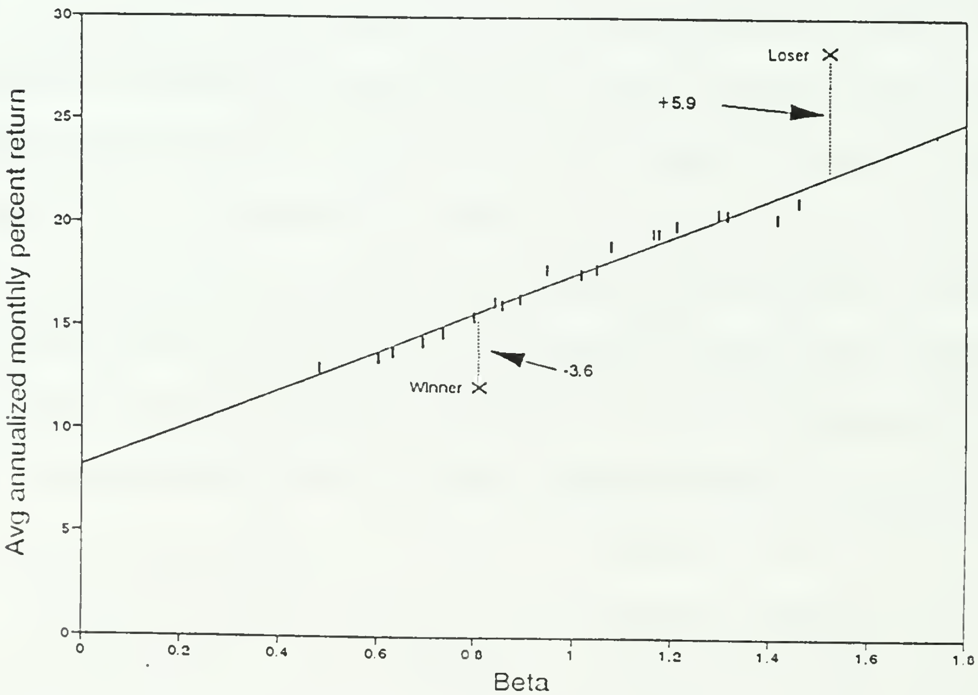

Fig. 1b. Similiar to Figure 1a, except that monthly returns are used, which are then annualized by multiplying by 12 before plotting.

The empirical SML has an intercept of 8.2 percent and a slope of 9.3 percent. Alphas are calculated as deviations from the empirical SML. The mean annualized return is 17.5 percent rather than the 18.0 percent in Figure 1a due to our procedure of multiplying the average monthly returns by 12, rather than compounding them.

between the extreme winners and losers widens from the 2.5 percent reported using an equally-weighted market index to 4.7 percent using a value-weighted index.

The discussion so far has focused on annual measurement intervals, even though monthly measurement intervals are much more commonly used in financial research. To examine the sensitivity of the results to the use of different measurement intervals, in columns (9)-(11) of Table 1 we report monthly returns, alphas, and betas using an equally-weighted index. This procedure produces a slightly smaller spread in betas (0.71 vs 0.79 when annual measurement intervals are used), and a greater difference in abnormal returns (0.50 percent per month, or 6.0 percent per year) between extreme winner and loser portfolios. Using the empirical Security Market Line calculated from monthly data with portfolios formed on the basis of ranked prior betas, extreme losers outperform extreme winners by 9.5 percent per year. With a value-weighted index using monthly data, the difference in alphas between extreme losers and winners is 12 percent per year using the Sharpe-Lintner model as the benchmark. (These results are not reported here.) Using the empirical Security Market Line, the difference would be even larger.

C. Asymmetries in beta changes

The RATS procedure is ideally suited for estimating event time-varying betas in a situation where the sample firms are experiencing dramatic changes in their market capitalization over relatively short intervals. In the context of this study, substantial differences in betas

Table 2

RATS betas on winner and loser portfolios for each event year from -6 to +5 for ranking periods in all markets, down markets ($r_{mt}-r_{ft} < 0$), and up markets ($r_{mt}-r_{ft} > 0$). Years -6 to -5 are the pre-ranking period, years -4 to 0 are the ranking period, and years +1 to +5 are the post-ranking period.[a]

$$r_{pt} - r_{ft} = \alpha_p + \beta_p(r_{mt}-r_{ft}) + \epsilon_{pt}$$

Year relative to ranking year 0	Beta coefficient estimates					
	All 52 years		Years when $r_m-r_f < 0$ only		Years when $r_m-r_f > 0$ only	
	Winners	Losers	Winners	Losers	Winners	Losers
-6	1.15	1.19	1.20	1.03	1.01	1.10
-5	1.21	1.12	1.12	1.07	1.17	1.06
-4	1.58	0.78	1.11	0.96	2.02	0.52
-3	1.52	0.83	0.99	0.87	1.86	0.58
-2	1.47	0.95	0.99	0.75	1.78	0.83
-1	1.48	1.02	0.98	0.86	1.72	0.99
0	1.21	1.06	0.94	0.83	1.13	1.03
+1	0.85	1.54	0.94	0.97	0.63	1.73
+2	0.79	1.63	0.93	1.26	0.56	1.89
+3	0.86	1.54	0.80	1.22	0.74	1.71
+4	0.94	1.55	0.72	1.08	0.95	1.78
+5	0.88	1.61	0.77	0.95	0.88	1.88
Average, -6 to -5	1.18	1.15	1.16	1.05	1.09	1.08
Average, -4 to 0	1.45	0.93	1.00	0.85	1.70	0.79
Average, +1 to +5	0.86	1.57	0.83	1.10	0.75	1.80

[a] Winner and loser portfolios consist of the stocks with the most extreme total returns over the five years -4 to 0. The 50 best and the 50 worst stocks in each ranking are assigned to the winner and loser portfolios. In the first 2 columns, α_p and β_p coefficients are estimated using a time series of 52 annual portfolio returns, using Ibbotson's (1975) RATS methodology. For years -6 and -5, respectively, 50 and 51 annual returns are used because of the lack of CRSP data for 1924 and 1925. There are between 15 and 21 down market years, and 31 to 37 up market years, for the years -6 to +5. Riskless annual returns are from Ibbotson Associates (1988). The market return is defined to be the equally-weighted market return on NYSE stocks meeting the sample criteria of at least 5 years of returns.

between winners and losers are observed using this procedure.[10] One of the attractive features of the RATS procedure is that one can observe on a period-by-period basis how the betas are changing within the ranking or post-ranking periods.

[Insert Table 2 about here]

Ball and Kothari present evidence, in their Tables 4 and 5 and Figure 1, that the betas of winner and loser portfolios change over time in the direction that would be predicted due to leverage changes. These patterns are replicated in columns (1) and (2) of our Table 2. In this table, following De Bondt and Thaler (1985) and Ball and Kothari (1989), we have defined winners and losers to be the 50 stocks with the most extreme ranking-period returns. We have calculated betas in each year of a 2-year pre-ranking period (years -6 to -5), the ranking period (years -4 to 0), and the post-ranking period (years +1 to +5). The changes in the betas from the pre-ranking period to the ranking period, and from the ranking period to the post-ranking period, are striking. The ranking period betas appear to suffer from severe biases. Apparently, the timing of the extreme returns on winners (and losers) is correlated with the market excess return. What is particularly noteworthy is that in the pre-ranking period, the firms that subsequently become the extreme winners and losers have betas that are practically indistinguishable from each other.[11] From year

[10]Chan (1988, p. 160) reports post-ranking period betas on winner and loser portfolios of 1.315 and 1.208, respectively. He uses monthly data to estimate market model parameters during a 36 month post-ranking period. His sample involves portfolios formed every 3 years, rather than every year, as we do.

[11] The betas of both the subsequent winners and losers are above 1.0 during the pre-ranking period. This is a consequence of the fact that small firms tend to have high betas, and firms with a lot of unique risk are

-5 to -4, the beta of the winner portfolio jumps from 1.21 to 1.58, whereas the beta of the loser portfolio falls from 1.12 to 0.78. These dramatic shifts are in the opposite direction to the changes predicted by the leverage hypothesis.

The leverage hypothesis predicts that, since year -4 is part of the ranking period, the equity beta of winners should fall, and equity beta of losers should rise. (In the ranking period, the winners have an average annual raw return of 55 percent for 5 years, while the losers have an average annual raw return of -9 percent for 5 years.) Throughout the ranking period, the betas of the winners remain high and the betas of the losers remain low. As soon as the ranking period ends, there is another huge change in betas. Between years 0 and +1, the winner's betas decrease by 0.36, and the loser's betas increase by 0.48, a combined swing of 0.84. One would expect a much smaller change, given that the market capitalizations change by a smaller amount between years 0 and +1 than between any two adjacent years during the ranking period. In contrast, the swing in betas during the entire 5 year ranking period in which the relative market capitalizations changed dramatically is only 0.65 (0.27 for winners, and 0.38 for losers).

These abrupt changes in betas cast doubt on the hypothesis that the changes are primarily due to movements in leverage. Thus, a fundamental question is raised about just what phenomenon is being captured by the betas of the winners and losers. The puzzle deepens when the patterns in

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overrepresented among both extreme winners and extreme losers. Large firms are generally more diversified, and are thus less likely to become extreme winners or losers.

betas for up and down markets are observed.[12] During down markets, defined as years for which $r_m - r_f < 0$, the betas of winner and loser portfolios show little variation between the ranking and post-ranking periods. Furthermore, in the post-ranking period the down-market betas differ by only 0.27 (0.83 for winners, 1.10 for losers). In contrast, during up markets, defined as years for which $r_m - r_f > 0$, the betas of winners fall by roughly half from the ranking period to the post-ranking period, while the betas of losers approximately double. Furthermore, during the post-ranking period, the up-market betas of winners and losers differ by a full 1.05 (0.75 for winners, 1.80 for losers). Thus, the large difference in betas between winners and losers in the post-ranking period emphasized by Ball and Kothari is driven primarily by the extraordinarily high betas on losers during up markets. Thus, while the difference in betas during the post-ranking period between portfolios comprised of the 50 most extreme winners and losers is 0.70 (0.80 using extreme vitile portfolios in Table 1), we have serious reservations whether the difference in risk that investors face is actually of this magnitude.

What is beta capturing? This is an open issue that requires further study. Work by Bhandari (1988), Braun, Nelson, and Sunier (1990), and Kan (1991) finds only a weak association between changes in leverage and equity betas.

D. Size-adjusted excess returns

The discussion so far has focused on how to adjust for differences in

[12] De Bondt and Thaler (1987) first documented these differences in betas between up and down markets.

betas between winners and losers. However, winners and losers differ on another dimension as well. Prior research, (e.g., Zarowin (1990)) has found that on average losers have lower market capitalizations than winners, indicating that measurement of excess returns must be careful to control for size effects. The correlation of size and prior returns is apparent from inspection of Figure 2, in which we have plotted the percentage of each size quintile that falls into each prior return quintile. (We plot quintile results, rather than the vitile portfolios that we use in the empirical work, to minimize the clutter that would otherwise obscure the figure.) For example, inspection of Figure 2 shows that in the smallest size quintile, 40 percent of the firms are in the extreme loser quintile, while only 10 percent are in the extreme winner quintile. As a consequence of this correlation of size and prior returns, a simple size adjustment may cause one to underestimate the extent of any overreaction effect.

[Insert Figure 2 about here]

In column (1) of Table 3, we report the average annual returns on vitile portfolios (these numbers are the same as in column (1) of Table 1). In column (2), we report the returns on control portfolios formed by matching on size (we refer to these as size-control portfolios). To construct the size-control portfolios, at the end of each of the 52 portfolio formation periods, we take the population of firms and rank them on the basis of their market capitalization, and then assign the firms to 20 portfolios formed on the basis of size. In computing the average annual returns on these size vitile portfolios, we follow the same procedure as used in Table 1 with the prior return vitile portfolios. For each prior

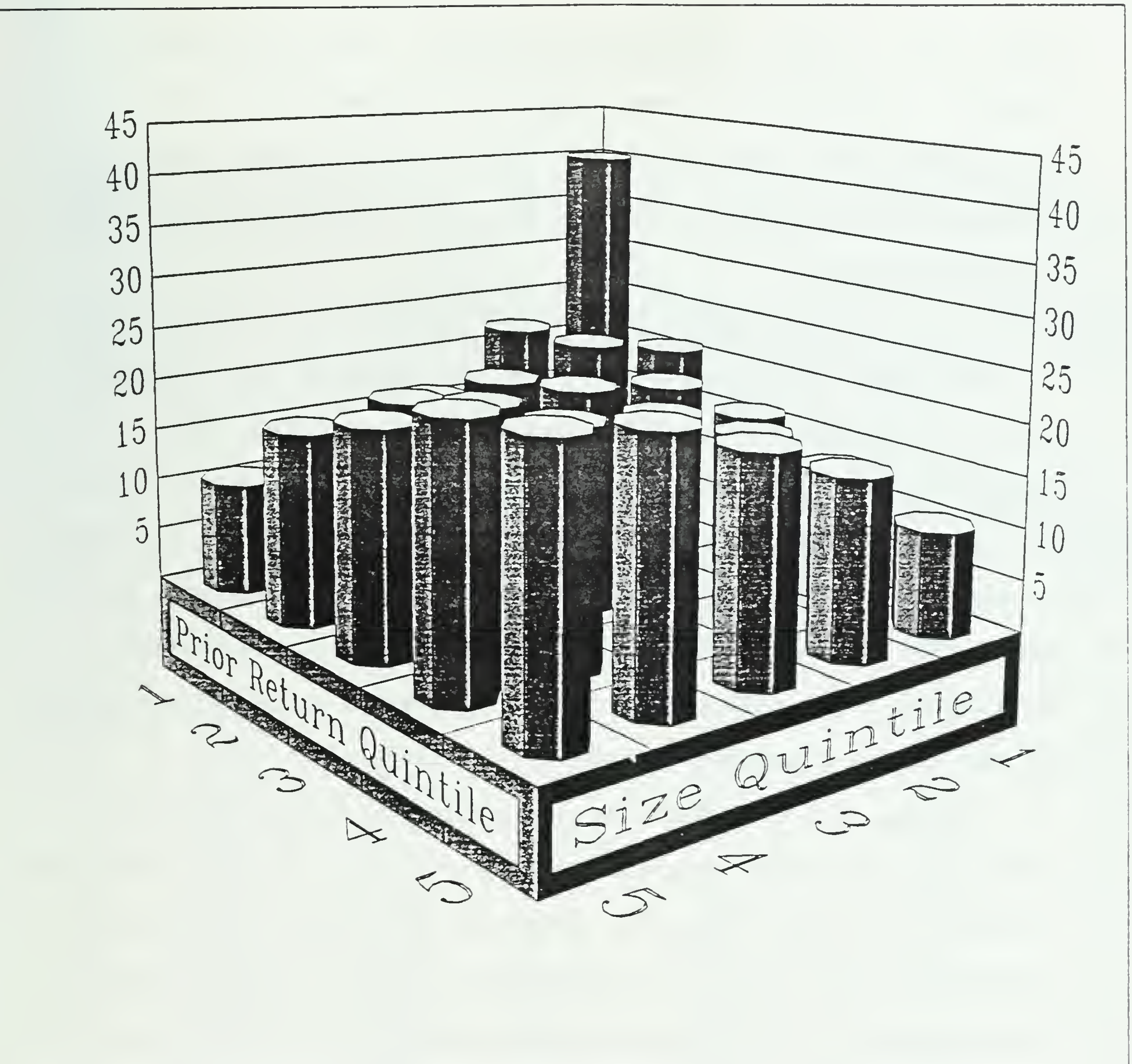

Fig. 2. The joint distribution of firms categorized by market capitalization and prior returns.

For each size quintile, the percentage of firms falling in each prior return quintile is plotted. Quintile portfolios are plotted rather than the vitile portfolios utilized in the empirical work because 400 portfolios (20x20) produces too cluttered a figure compared with the 25 portfolios plotted. Prior return quintile 1-losers, 5-winners. Size quintile 1-small, 5-large.

return vitile, we form a size-control portfolio. This size-control portfolio is constructed to have the same size composition as its corresponding prior return vitile portfolio, with the weights being determined by the proportion of the prior return vitile that fell in each size classification.

[Insert Table 3 about here]

In column (3) of Table 3, we report the average annual returns on size-control portfolios formed in a manner identical to that employed in column (2), with the exception that the population of firms from which the size portfolios are drawn has been purged of firms in prior return vitiles 1-5 (losers) and 16-20 (winners).[13] The purpose of this purging is to minimize the confounding of any overreaction effects with size effects. (It should be noted that purging the most extreme 25 percent of winners and the most extreme 25 percent of losers is arbitrary.)

In column (5) of Table 3, we report excess returns computed by subtracting the unpurged size-control returns. There is a nearly monotonic decrease in the excess returns as one goes from portfolio 1 (the losers) to portfolio 20 (the winners). The difference in excess returns between the extreme portfolios is 6.6 percent per year during the 5 post-ranking years.

In column (6), we report the excess returns computed using the purged size-control portfolios. The pattern in column (5) is accentuated, confirming our conjecture that controlling for size without taking the correlation of size and prior returns into account understates the overreaction effect. The difference between the extreme portfolio excess

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[13] Because of the correlation of size and prior returns, more than 50 percent of the smallest firms (and largest) are purged, and slightly less than 50 percent of moderate-size firms are purged.

Table 3

Average annual post-ranking period percentage returns for 20 portfolios of firms ranked by their five-year ranking period returns, size-control portfolios with and without losers and winners purged, and the associated excess returns.

The 20 size-control portfolios are constructed to have approximately the same market values as the 20 ranked portfolios. Excess returns are computed two different ways: (i) size-adjusted returns using all firms (unpurged), and (ii), size-adjusted returns after the firms have been purged of all firms in the top 5 and the bottom 5 vitiles of prior returns (purged).

	Average annual return in years +1 to +5				Excess returns $e = r_p - r_s$	
	Ranked	Control firms				
Portfolio	firms (r_p) (1)	Unpurged (r_s) (2)	Purged (r_s) (3)	Difference (2)-(3) (4)	Unpurged (1)-(2) (5)	Purged (1)-(3) (6)
1	27.3	23.4	20.4	3.0	3.9	6.9
2	23.0	21.3	19.3	2.0	1.7	3.7
3	21.0	20.6	19.0	1.6	0.4	2.0
4	21.2	20.0	18.8	1.2	1.2	2.4
5	20.5	19.4	18.0	1.4	1.1	2.5
6	19.9	18.8	18.0	0.8	1.1	1.9
7	19.4	18.9	18.1	0.8	0.5	1.3
8	18.5	18.1	17.6	0.5	0.4	0.9
9	17.6	17.9	17.4	0.5	-0.3	0.2
10	17.8	17.5	17.2	0.3	0.3	0.6
11	16.9	17.3	16.9	0.4	-0.4	0.0
12	16.6	17.0	16.7	0.3	-0.4	-0.1
13	16.7	16.9	16.8	0.1	-0.2	-0.1
14	16.1	16.6	16.3	0.3	-0.5	-0.2
15	15.5	16.6	16.4	0.2	-1.1	-0.9
16	15.3	16.6	16.4	0.2	-1.3	-1.1
17	14.6	16.2	16.1	0.1	-1.6	-1.5
18	14.5	16.0	16.1	-0.1	-1.5	-1.6
19	14.3	16.0	15.9	0.1	-1.7	-1.6
20	13.3	16.0	16.1	-0.1	-2.7	-2.8
Mean	18.0	18.0	17.4	0.6	0.0	0.6
r_1-r_{20}	14.0	7.4	4.3	3.1	6.6	9.7

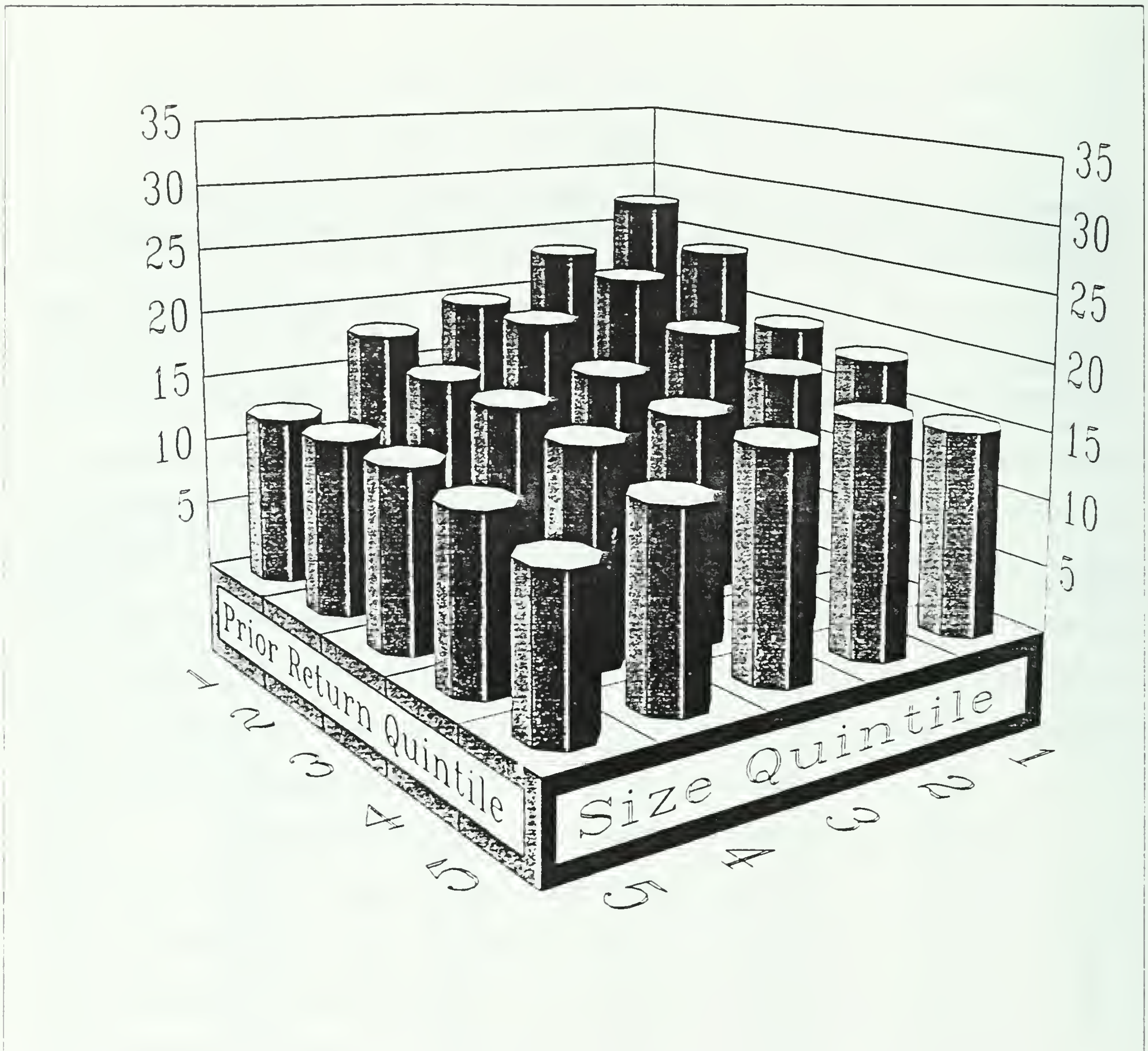

Fig. 3. The joint distribution of average annual returns in the post-ranking period categorized by market capitalization and prior returns.

The average annual return on the smallest quintile of losers is 27.37 percent, while the average annual return on the largest quintile of winners is 11.59 percent. Prior return quintile 1=losers, 5=winners. Size quintile 1=small, 5=large.

returns is 9.7 percent per year during the 5 post-ranking years. From these numbers, it appears that there is an economically significant overreaction effect above and beyond any size effect.

[Insert Figure 3 about here]

In Figure 3, we plot the joint distribution of annual raw percentage returns for the same quintile portfolios used in Figure 2. Inspection of this figure shows that, holding size constant, returns are higher the lower are prior returns, and holding prior returns constant, returns are higher the smaller is size. On average, holding size constant, the extreme loser quintile has a 5.4 percent higher average annual return than the extreme winner quintile. On average, holding prior returns constant, the smallest size quintile has an 8.2 percent higher average annual return than the largest size quintile. However, before concluding that there is an economically significant overreaction effect, an adjustment for beta risk must also be made.

3. Multivariate tests

The previous section demonstrated that after controlling for size effects, an economically significant overreaction effect persisted. Our size-control analysis did not incorporate the effect of beta on returns, however. In this section, we present multiple regression evidence that simultaneously incorporates the effects of beta, size, and prior returns on post-ranking period returns. This analysis uses 400 portfolios, each containing an unequal number of firms, formed on the basis of independent vitile rankings of firm size and prior returns. For each of these portfolios, a beta is calculated from a pooled (across both post-ranking

years and firms) regression, using $r_{it}-r_{ft}$ as the dependent variable and $r_{mt}-r_{ft}$ as the explanatory variable, where r_{it} is the return on firm i in year t. The raw portfolio return is also calculated as the pooled (across both firms and post-ranking years) average return.[14]

In the appendix we report results using two alternative procedures for calculating betas and returns for each of the 400 portfolios. In general, the results are qualitatively similar.

[Insert Table 4 about here]

In Panels A-D of Table 4, we report the results of estimating equation (2) using these 400 portfolios:

$$r_p-r_f = a_0 + a_1SIZE_p + a_2RETURN_p + a_3beta_p + e_p \qquad (2)$$

The explanatory variables in Panels A-D are relative market capitalization (SIZE), measured as the portfolio vitile rank (1 small, 20 large), prior five-year returns (RETURN), measured as the portfolio vitile rank (1 losers, 20 winners), and the portfolio beta.[15] In Panel A, using annual returns, we find that all three explanatory variables are highly

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[14]When annual returns are used, if a given portfolio, e.g., the smallest extreme losers (size vitile 1, return vitile 1) has a total of 83 firms in it over the entire 52 formation periods (an average of 1.6 firms per formation period), there are up to 83x5 annual returns (if each of the 83 firms lasted for all five post-ranking years).

[15] We have explored some alternatives to our use of vitile rankings as measures of prior returns and size. For example, using the actual prior return rather than the vitile rank produces a slightly better fit and a stronger measured overreaction effect. One reason for our preference for the use of vitile rankings to measure size is that market capitalizations changed substantially over time during our 52 year sample period. This poses a problem for pooling observations over time. For a detailed discussion of some of the issues involved, see Chan, Hamao, and Lakonishok (1991). We have not attempted to conduct a comprehensive examination of alternative specificiations, for this would then introduce data-snooping biases. To the degree that we have made only a limited attempt to examine alternative specifications, the magnitude of our reported overreaction effect may be conservative.

Table 4

OLS regressions of portfolio average annual excess returns for the first five post-ranking years for portfolios of NYSE firms formed on the basis of size and prior returns.

For each of the 52 ranking periods ending on December 31 of 1930 to 1981, firms are independently ranked on the basis of their December 31 market value and their five-year prior return, and assigned to one of 400 portfolios based upon these vitiles. Each portfolio beta is the pooled (over firms and post-ranking years) beta for the firms in the cell, calculated using the annual returns and equally-weighted market returns. SIZE is measured as the vitile ranking (1 to 20, with 1 being smallest), and RETURN is measured as the vitile ranking (1 to 20, with 1 being the most extreme prior losers). In Panels E-H, DS is a dummy variable equal to 1 if a portfolio is among the bottom 40 percent of SIZE vitiles, DM is a dummy variable equal to 1 if a portfolio is among SIZE vitiles 9 to 16 (the middle 40 percent), and DL is a dummy variable equal to 1 if a portfolio is among the largest 20 percent of SIZE vitiles. T-statistics are in parentheses.

$$r_p - r_f = a_0 + a_1 SIZE_p + a_2 RETURN_p + a_3 Beta_p + e_p$$

intercept	SIZE	RETURN	Beta	R^2 adjusted
	coefficient estimates			
Panel A: Annual percentage returns				
14.443	-0.364	-0.254	5.438	0.68
(10.812)	(-10.491)	(-10.508)	(6.123)	
Panel B: Monthly percentage returns, all months				
1.236	-0.031	-0.023	0.369	0.68
(9.138)	(-10.298)	(-11.388)	(3.948)	
Panel C: Monthly percentage returns, Januaries only				
3.271	-0.212	-0.104	4.329	0.90
(8.251)	(-20.862)	(-12.275)	(17.309)	
Panel D: Monthly percentage returns, Feb.-Dec. only				
0.958	-0.012	-0.012	0.034	0.22
(7.656)	(-4.478)	(-6.506)	(0.378)	

$$r_p - r_f = a_0 + a_1 SIZE_p + a_2 DS \bullet RETURN_p + a_3 DM \bullet RETURN_p + a_4 DL \bullet RETURN_p + a_5 Beta_p + e_p$$

intercept	SIZE	DS•RETURN	DM•RETURN	DL•RETURN	Beta	R^2 adjusted
		coefficient estimates				
Panel E: Annual percentage returns						
18.113	-0.597	-0.417	-0.182	-0.136	4.364	0.72
(13.559)	(-13.093)	(-13.428)	(-7.176)	(-3.783)	(5.176)	
Panel F: Monthly percentage returns, all months						
1.631	-0.055	-0.039	-0.018	-0.010	0.238	0.73
(12.576)	(-14.557)	(-15.589)	(-8.708)	(-3.658)	(2.759)	
Panel G: Monthly percentage returns, Januaries only						
4.817	-0.311	-0.167	-0.095	-0.034	3.904	0.92
(12.252)	(-22.641)	(-16.203)	(-11.559)	(-3.087)	(16.931)	
Panel H: Monthly percentage returns, Feb.-Dec. only						
1.199	-0.026	-0.022	-0.007	-0.006	-0.051	0.29
(9.508)	(-7.226)	(-9.062)	(-3.664)	(-2.132)	(-0.590)	

significant and the coefficients have the predicted signs. Furthermore, a large fraction of the variation in portfolio returns is explained (the R^2 is 0.68). The RETURN coefficient of -0.254 implies that after controlling for size and beta, extreme losers outperform extreme winners by 4.8 percent per year on average for the 5 post-ranking years. [Since RETURN (and SIZE) is measured as the vitile rank, -0.254 multiplied by 1-20 results in the 4.8 percent difference.] Also noteworthy is that in Panel A, the coefficent on beta of 5.438 percent is lower than the 9.402 percent slope reported in Figure 1. Apparently, estimates of the SML slope from single variable regressions suffer from an omitted variable bias. Another aspect worth noting is that the magnitude of the overreaction effect is nearly as great as that of the size effect, as can be seen by comparing the two coefficients.

To examine how sensitive these conclusions are to the use of annual returns rather than the monthly returns that are more commonly used in empirical studies, and to examine seasonal effects, in Panels B-D results from monthly regressions are reported. (In Panels B-D, we use monthly returns to calculate betas.) Panel B reports results that, after multiplying the monthly coefficients by 12, are qualitatively similiar to those in Panel A. The overreaction effect is slightly stronger, with Panel B reporting that extreme losers outperform extreme winners by 5.2 percent per year, ceteris paribus. The compensation per unit of beta is 4.4 percent per year using monthly data, a decrease from the 5.4 percent per year reported in Panel A using annual returns.

In Panels C and D, we examine whether the overreaction effect is present in both January and non-January months. This is motivated by De

Bondt and Thaler's (1985) Figure 3 diagram, as well as the work of Fama and French (1986) and Zarowin (1990), where a pronounced January seasonal is apparent. In these panels, separate betas are calculated for the January and non-January months for each of the 400 portfolios. Inspection of Panels C and D shows that SIZE, RETURN, and beta have much stronger effects in January than in the non-January months, consistent with previous findings. What is most noteworthy, however, is that the majority of the annual overreaction effect occurs outside of January. This can be seen by multiplying the non-January coefficient on RETURN of -0.012 by 11, and comparing it with the January RETURN coefficent of -0.104. This analysis indicates that 56 percent [.132/(.104+.132)] of the annual overreaction effect occurs in non-January months.[16]

In Panels E-H, we permit the overreaction effect to vary by firm size by estimating three different slope coefficients, depending upon whether a portfolio is comprised of small, middle-size, or large firms. Panel E reveals that the overreaction effect is strongest among smaller firms. The DS•RETURN coefficent of -0.417 implies a 7.9 percent per year abnormal return difference between vitiles 1 and 20 for the bottom 40 percent of market capitalization firms. For middle-size firms, this difference is 3.5 percent, while for the larger (upper 20 percent) firms, the difference is 2.6 percent. This dependency of the extent of overreaction on firm size has not previously been noted.

The results in Panels F-H are consistent with the conclusions from the other panels. For all size groups, the overreaction effect is stronger

[16] In these results, we have computed separate betas for January and non-January months. When we restrict the betas to be the same in all 12 calendar months, almost all of the overreaction effect is concentrated in January.

in January than in the non-January months. To examine the robustness of our Table 4 results, we have also run the regressions for subperiods (1931-56 and 1957-82). These results (not reported here) indicate that there is a significant overreaction effect in both subperiods, although the effects are stronger in the second subperiod. This is in contrast to the evidence on index autocorrelations over 3-5 year periods reported by Fama and French (1988), where they find weaker results for subperiods excluding the 1930s.

[Insert Table 5 about here]

The evidence in Panels E-H of Table 4 demonstrates that the overreaction effect is stronger for smaller firms. This finding deserves further analysis. In Table 5, we examine the extent of overreaction within each of ten size deciles by reporting regression results with RETURN and beta as explanatory variables. Each of the 10 regressions utilizes the 40 portfolios out of the 400 formed for our Table 4 analysis that correspond to the appropriate size grouping. In Table 5, the coefficent on RETURN is generally closer to zero the larger is the size decile. The last column in the table reports the implied annual difference in returns between the extreme winner and loser vitiles, holding size and beta constant. These differences in returns are plotted in Figure 4. The numbers demonstrate that for the smaller firms, an overreaction effect on the order of 10 percent per year (50 percent per 5 years!) is present, while for the largest 20 percent of NYSE firms (roughly the S&P 500), no overreaction effect is apparent. Since individuals are the primary holders of the smaller firms, while institutions are the dominant holders of the larger firms, the results are consistent with the hypothesis that individuals overreact, while institutional investors do not. Others, such as Shiller

Table 5

OLS regressions of portfolio annual average percentage excess returns on ranking-period return vitiles and beta by size decile.

RETURN is measured 1 to 20 (1 = losers, 20 = winners), where prior returns are measured over the 5 years prior to the portfolio formation date. Firms are assigned to size deciles on the basis of their market capitalization at the end of the ranking period. The beta of each portfolio is calculated as the pooled (over firms and post-ranking years) beta. Each of the 10 regressions uses 40 observations (2 vitiles of size with 20 prior return vitile portfolios in each size vitile). T-statistics are in parentheses.

$$r_p - r_f = a_0 + a_1 RETURN_p + a_2 Beta_p + e_p$$

	coefficient estimates				-19xRETURN
Size decile	intercept	RETURN	beta	$R^2_{adjusted}$	coefficient
1 (small)	9.888 (3.223)	-0.578 (-7.209)	9.980 (5.026)	0.76	10.98%
2	27.658 (5.990)	-0.729 (-9.874)	-2.784 (-0.787)	0.74	13.85%
3	21.218 (6.265)	-0.510 (-7.217)	0.402 (0.154)	0.65	9.69%
4	18.942 (6.271)	-0.350 (-5.303)	0.739 (0.314)	0.51	6.65%
5	16.356 (4.790)	-0.140 (-2.147)	-0.641 (-0.219)	0.10	2.66%
6	14.226 (5.299)	-0.293 (-4.666)	2.489 (1.159)	0.52	5.57%
7	9.149 (4.638)	-0.153 (-3.129)	4.838 (2.981)	0.51	2.91%
8	8.018 (3.903)	-0.113 (-2.435)	5.171 (2.634)	0.37	2.15%
9	6.101 (2.175)	-0.016 (-0.279)	4.524 (1.385)	0.01	0.30%
10 (large)	5.080 (2.749)	0.040 (1.333)	2.471 (0.899)	0.01	-0.76%

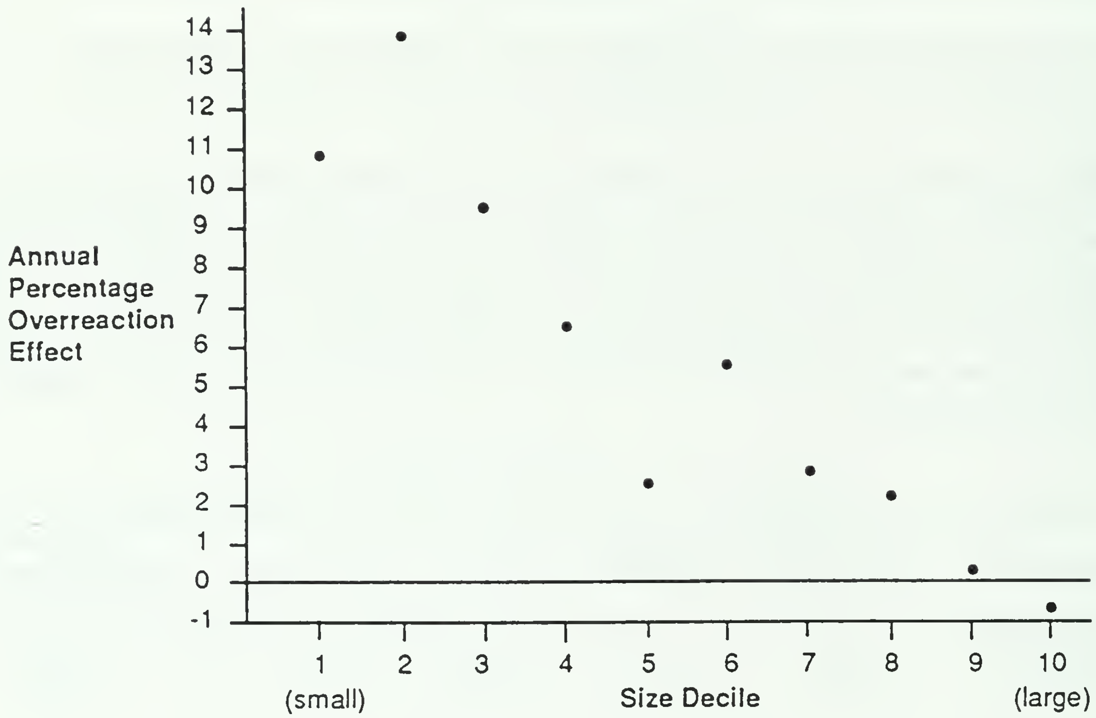

Fig. 4. The difference in annual abnormal returns between extreme loser and winner portfolios by size decile.

The numbers plotted are the coefficients on RETURN in Table 5 multiplied by -19. This represents the expected difference in annual returns for the 5 post-ranking years between prior return vitiles 1 and 20, controlling for beta, for firms categorized by their size decile.

(1984), have made conjectures along these lines.

[Insert Figure 4 about here]

Our finding that overreaction is concentrated among smaller firms is consistent with results reported in Fama and French (1988), where small-firm portfolios are found to have greater negative serial correlation than large-firm portfolios. Furthermore, Poterba and Summers (1988) provide evidence that there is more overreaction in countries with less-developed capital markets than in countries such as the U.S. or Britian. Together, this evidence is consistent with the hypothesis that the further one moves away from large capitalization stocks in well-developed capital markets, the more likely it is that stocks take prolonged swings away from their fundamental value.

Another noteworthy aspect of the Table 5 regressions is that, in contrast to the importance of the RETURN variable, which is statistically significant at the 5 percent level for all but the largest two size deciles, the coefficient on beta is highly variable and statistically significant in only three of the ten regressions. For the largest two size deciles, which account for the majority of market capitalization, beta is not statistically significant. For these two deciles, the compensation per unit of beta risk is substantially below the 5.4 percent reported in Panel A of Table 4, and the 9.4 percent reported in Figure 1a.

4. <u>Evidence from earnings announcement dates</u>

The evidence presented so far indicates that even after controlling for size and beta effects, there is an overreaction effect. However, because the magnitude of any effect measured over long intervals is

sensitive to the benchmark employed, we also present evidence of overreaction around earnings announcements. Focusing on short windows such as the three-day period surrounding earnings announcements minimizes the sensitivity of results to misspecification of controls. This can provide further evidence on the existence of an overreaction effect. However, it cannot shed much light on the exact magnitude because there is no reason why the return towards fundamental value should occur on only a few discrete dates.

For the firms in the ranking periods ending in 1970-81, we searched the Compustat quarterly industrial, historical, and research files for their quarterly earnings announcements in the first 5 years of the post-ranking periods.[17] This resulted in 227,522 earnings announcements. For each of the vitile portfolios formed by ranking firms on prior returns, we computed the average raw return for earnings announcements for a three-day window of [-2,0] relative to the Compustat-listed announcement date. This 3-day window is commonly used in the earnings announcement literature (e.g., Bernard and Thomas (1991)).

[Insert Figure 5 about here]

In Figure 5, we have plotted the raw 3-day earnings announcement period returns using the same size and prior-return quintiles as in Figures 2 and 3. The small losers have average returns of 0.958 percent per 3

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[17] The quarterly industrial file contains only companies that are currently publicly-traded. The research file contains companies that were delisted. Combining these data files gives us a sample that covers almost all of the NYSE firms in our sample, but only for the most recent 48 quarters. Combining the historical data extends the sample back into the 1970s. Compustat's data on quarterly earnings announcement dates becomes progressively less comprehensive for earlier years, which is why we restrict our analysis to the 1970s and 1980s, rather than use 52 years of data.

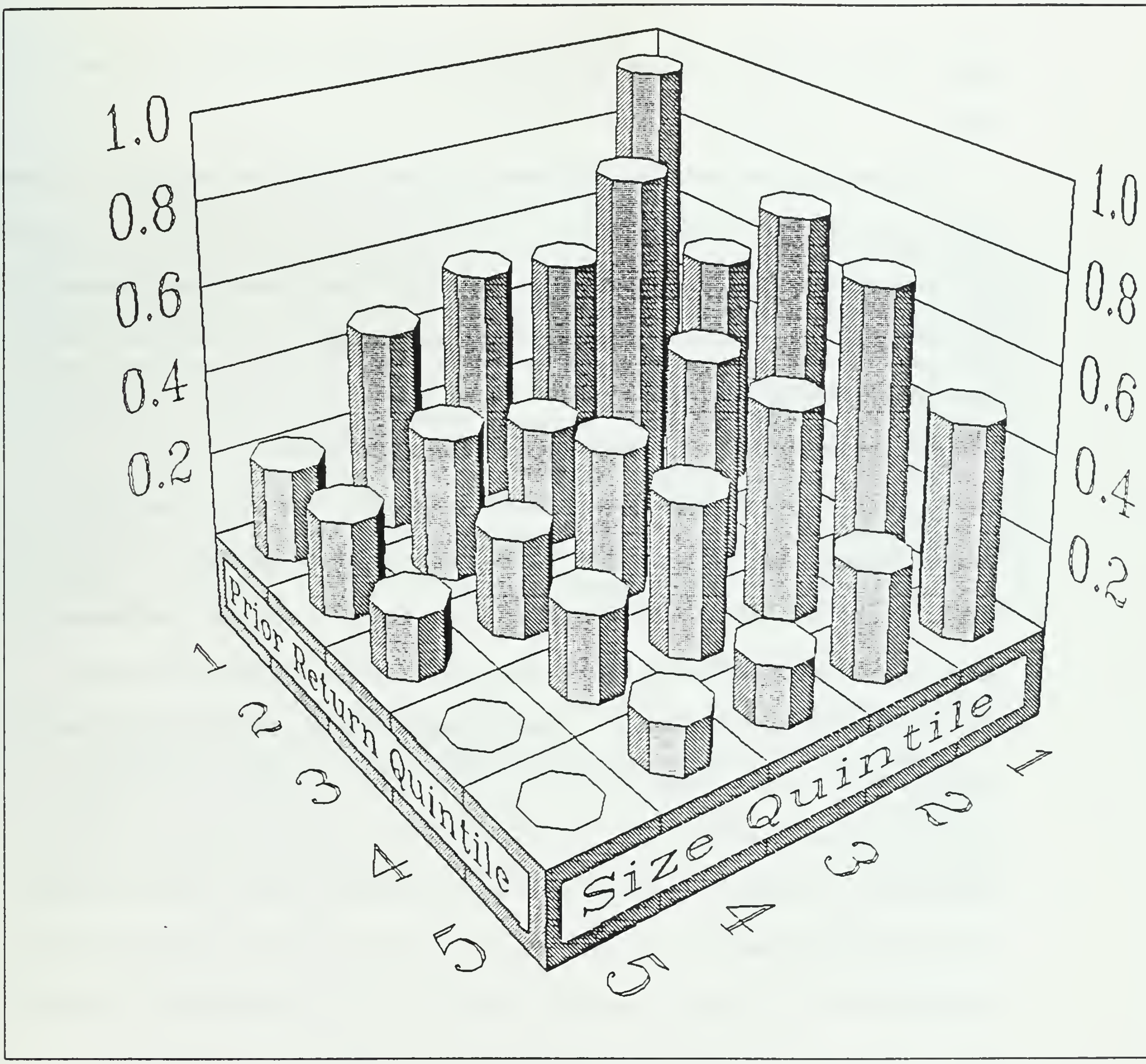

Fig. 5. The joint distribution of 3-day earnings announcement returns categorized by market capitalization and prior returns.

Firms are assigned to portfolios based upon independent rankings of size and prior returns. The average 3-day raw return at subsequent earnings announcements is computed for Compustat-listed quarterly earnings announcement dates during the 5-year post-ranking period. The average 3-day raw return is 0.001 percent for the largest extreme winners, and 0.958 percent for the smallest extreme losers.

days, while the large winners have average returns of 0.001 percent per 3 days.

Returning to the vitile portfolios, the average earnings announcement period return for firms in vitile 1 (losers) is 0.63 percent. For firms in prior return vitile 20, the average earnings announcement period return is zero. Thus, the evidence from earnings announcements indicates that the market is systematically surprised at subsequent earnings announcements in a manner consistent with the overreaction hypothesis.

Recent research, however, finds anomalous returns at earnings announcement dates.[18] In particular, as documented by Chari, Jagannathan, and Ofer (1988), small firms tend to have higher earnings announcement period returns than large firms, and in our case, a disproportionate fraction of losers are small. Chari, Jagannathan, and Ofer hypothesize that because of the increased flow of information around earnings announcements, these periods are riskier than non-announcement periods. Therefore, to examine whether past price changes impact returns around earnings announcements, we have to control for both size and risk. This is accomplished by using an approach similiar to that employed in equation (2). The analysis utilizes 400 portfolios formed on the basis of independent rankings of firm size and prior returns. For each of these 400 portfolios, we compute an average raw 3-day holding period return. We also calculate a portfolio beta by running a pooled market model regression (over both firms and earnings announcements) using 3-day announcement period returns and 3-day market returns.

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[18] Much of the literature on earnings announcements is surveyed in Ball and Kothari (1991).

Table 6

Regression of three-day earnings announcement portfolio returns on size, prior returns, and beta.

394 portfolios are used (400 portfolios based on independently ranking firms by size vitiles and by prior return vitiles, with 6 portfolios deleted that had fewer than 100 earnings announcements). Size is measured with the smallest firms in portfolio 1, and the largest in portfolio 20. Prior returns (measured over the five prior years) are also ranked from 1 to 20, with 1 being the losers. Betas are calculated for each portfolio using all earnings announcement returns for all firms in the portfolio. The dependent variable is measured as the percentage return per 3-day announcement period [-2,0], for earnings announcements made during the first five post-ranking years. Earnings announcement days are from Compustat's industrial, historical, and research tapes, for announcements during the 5 post-ranking years following the ranking periods ending in 1970-81. There are 227,522 earnings announcements. T-statistics are in parentheses.

$$R_p = a_0 + a_1 SIZE_p + a_2 RETURN_p + a_3 Beta_p + e_i$$

	coefficient estimates			
intercept	SIZE	RETURN	Beta	$R^2_{adjusted}$
0.641	-0.027	-0.014	0.111	0.32
(7.506)	(-11.389)	(-5.752)	(1.674)	

[Insert Table 6 about here]

In Table 6 we report the results of a regression based on 400 observations where the portfolio 3-day return is the dependent variable. Explanatory variables are SIZE (as measured by the size vitile portfolio number), RETURNS (as measured by the prior returns vitile portfolio number), and beta. The coefficients indicate that, holding beta and firm size constant, the earnings announcement returns are more positive for prior losers than winners. In particular, -0.0142 times (1-20) is 0.27 percent per announcement. Since there are four quarterly earnings announcements per year, this is a difference of 1.08 percent during each calendar year for these 12 trading days alone. This reinforces our earlier results on the existence of an overreaction effect.

5. Summary and Conclusions

One of the most controversial issues in financial economics in recent years is the question of whether stocks overreact. De Bondt and Thaler (1985) present evidence that stocks with poor performance (losers) over the past 3-5 years outperform prior-period winners over the subsequent 3-5 years. This work has received considerable attention because the authors (i) find a very large difference in returns between winners and losers during the post-ranking period, about 8 percent per year during the next 5 years, and (ii) interpret their findings as evidence that there are systematic valuation errors in the stock market caused by overreaction by investors.

Subsequent papers suggest that De Bondt and Thaler's findings are subject to various methodological problems. In particular, Ball and Kothari (1989) show that when betas are estimated using annual returns, in

the context of the Sharpe-Lintner CAPM nearly all of the estimated abnormal returns disappear. In another paper, Zarowin (1990) argues that the overreaction effect is merely a manifestation of the size effect. It is apparent from the work in this area that the quantitative magnitude of the overreaction effect is highly sensitive to the procedures used in computing abnormal returns. This sensitivity is present in any study in which abnormal returns are being computed over multiple-year periods.

In this paper, we estimate time-varying betas but do not use the restrictive assumptions of the Sharpe-Lintner CAPM in computing abnormal returns for winners and losers. The Sharpe-Lintner model assumes that the compensation per unit of beta risk is about 14-15 percent per year when an equally-weighted market portfolio is used. Given that the betas of extreme winners and losers differ by about 0.8 when annual returns are used, an adjustment for beta risk explains a large portion of the overreaction effect. In this study we rely on the estimated market compensation per unit of beta risk, which is substantially smaller than that assumed by the Sharpe-Lintner model. We find results that are consistent with a substantial overreaction effect. Using annual return intervals, extreme losers outperform extreme winners by 6.5 percent per year. Using monthly return intervals, this spread increases to 9.5 percent per year. Furthermore, we demonstrate that the overreaction effect is not just a manifestation of the size effect. We demonstrate that the common procedure of adjusting for size underestimates the spread in abnormal returns between winners and losers. This is because part of the size effect is a manifestation of return reversals. After adjusting for size, but before adjusting for beta effects, we find that extreme losers outperform extreme

winners by 9.7 percent per year after purging size-control portfolios of winners and losers.

In general, because size, prior returns, and betas are correlated, any study that relates realized returns to just one or two of these variables suffers from an omitted variable bias. In the context of a multiple regression using all three of these variables, we find an economically significant overreaction effect of 4.8 percent per year using annual data and 5.2 percent using monthly data. Although disproportionately in January, a substantial fraction of the overreaction effect is present in the non-January months as well.

The overreaction effect, however, is not homogeneous across size groups. Instead, it is much stronger for smaller companies than for larger companies, with extreme losers outperforming extreme winners by about 10 percent per year among small firms. These smaller firms are held predominantly by individuals. In contrast, there is virtually no evidence of overreaction among the largest 20 percent of market capitalization firms, where institutional investors are the dominant holders. This suggests that overreaction by individuals is more prevalent than overreaction by institutions.

In common with other studies that examine returns over long intervals, there is always the possibility that what we attribute to overreaction is instead equilibrium compensation for some omitted risk factor or factors. However, we feel that our results cannot be entirely explained by risk mismeasurement since returns consistent with overreaction are observed for the short windows surrounding quarterly earnings announcement days. We find that even after adjusting for the size effect

and the higher risk that is present at earnings announcements, losers have significantly higher returns than winners.

In summary, we have documented an economically important overreaction effect in the stock market, concentrated among smaller firms. While the underlying reasons for the valuation errors have not been uncovered, the fact that the effect is strongest for smaller stocks may indicate that a productive area for future research is understanding the difference in the patterns of investing by individuals and institutions.

Appendix Table 1

OLS regressions of portfolio average annual percentage excess returns for the first five post-ranking years for portfolios of NYSE firms formed on the basis of size and prior returns.

For each of the 52 ranking periods ending on December 31 of 1930 to 1981, firms are independently ranked on the basis of their December 31 market value and their five-year prior return, and assigned to one of 400 portfolios based upon these vitiles. SIZE is measured as the vitile ranking (1 to 20, with 1 being smallest), and RETURN is measured as the vitile ranking (1 to 20, with 1 being the most extreme prior losers). T-statistics are in parentheses. Annual returns and an equally-weighted market index are used in all three panels.

This table reports regression results that are similiar to Panel A of Table 4 in the text, except that the betas and returns for each of the 400 portfolios are calculated using alternative procedures. Panel A reports results using betas that are calculated by pooling observations across both firms and post-ranking event years. This is identical to Panel A in Table 4 of the text. Panels B and C report results using the two alternative procedures.

In Panel B, the procedure is analogous to that used in Table 1: for each of the 400 portfolios we run a time-series regression using (up to) 52 portfolio returns in each of the 5 post-ranking years, and then compute the portfolio beta as the average of these 5 numbers. A disadvantage of this procedure is that there are many portfolios that have missing observations in some of the 52 years.

In Panel C, the procedure used calculates separate betas for each of the 5 post-ranking years and then averages these 5 numbers to calculate the portfolio beta.

$$r_p - r_f = a_0 + a_1 SIZE_p + a_2 RETURN_p + a_3 Beta_p + e_p$$

coefficient estimates				
intercept	SIZE	RETURN	Beta	R^2adjusted
Panel A: Betas computed with pooling over both firms and event years				
14.443	-0.364	-0.254	5.438	0.68
(10.812)	(-10.491)	(-10.508)	(6.123)	
Panel A: Betas computed using the RATS procedure				
15.637	-0.290	-0.204	7.210	0.70
(13.350)	(-9.762)	(-8.569)	(9.461)	
Panel C: Betas computed with pooling over firms				
17.838	-0.314	-0.266	5.817	0.67
(13.410)	(-9.175)	(-11.166)	(6.564)	

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